National Institute of Environmental Health Sciences

Site-specific integration and expression of an anti-malarial gene in transgenic Anopheles gambiae significantly reduces Plasmodium infections

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Abstract:

Diseases transmitted by mosquitoes have a devastating impact on global health and this is worsening due to difficulties with existing control measures and climate change. Genetically modified mosquitoes that are refractory to disease transmission are seen as having great potential in the delivery of novel control strategies. Historically the genetic modification of insects has relied upon transposable elements which have many limitations despite their successful use. To circumvent these limitations the Streptomyces phage phiC31 integrase system has been successfully adapted for site-specific transgene integration in insects. Here, we present the first site-specific transformation of Anopheles gambiae, the principal vector of human malaria. Mosquitoes were initially engineered to incorporate the phiC31 targeting site at a defined genomic location. A second phase of genetic modification then achieved site-specific integration of Vida3, a synthetic anti-malarial gene. Expression of Vida3, specifically in the midgut of bloodfed females, offered consistent and significant protection against Plasmodium yoelii nigeriensis, reducing average parasite intensity by 85%. Similar protection was observed against Plasmodium falciparum in some experiments, although protection was inconsistent. In the fight against malaria, it is imperative to establish a broad repertoire of both anti-malarial effector genes and tissue-specific promoters for their expression, enabling those offering maximum effect with minimum fitness cost to be identified. In the future, this technology will allow effective comparisons and informed choices to be made, potentially leading to complete transmission blockade.

Source: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3026776

Resource Description

Exposure :

weather or climate related pathway by which climate change affects health

Ecosystem Changes, Temperature

Temperature: Fluctuations

Geographic Feature:

resource focuses on specific type of geography

None or Unspecified

Geographic Location:

resource focuses on specific location

Global or Unspecified

Health Impact:

specification of health effect or disease related to climate change exposure

Infectious Disease

Infectious Disease: Vectorborne Disease

Vectorborne Disease: Mosquito-borne Disease

Mosquito-borne Disease: Malaria

Intervention:

strategy to prepare for or reduce the impact of climate change on health

A focus of content

Mitigation/Adaptation:

mitigation or adaptation strategy is a focus of resource

Adaptation

Resource Type:

format or standard characteristic of resource

Research Article

Timescale:

time period studied

Time Scale Unspecified

Vulnerability/Impact Assessment:

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content